SCIENCE SERVING THE PRESENT

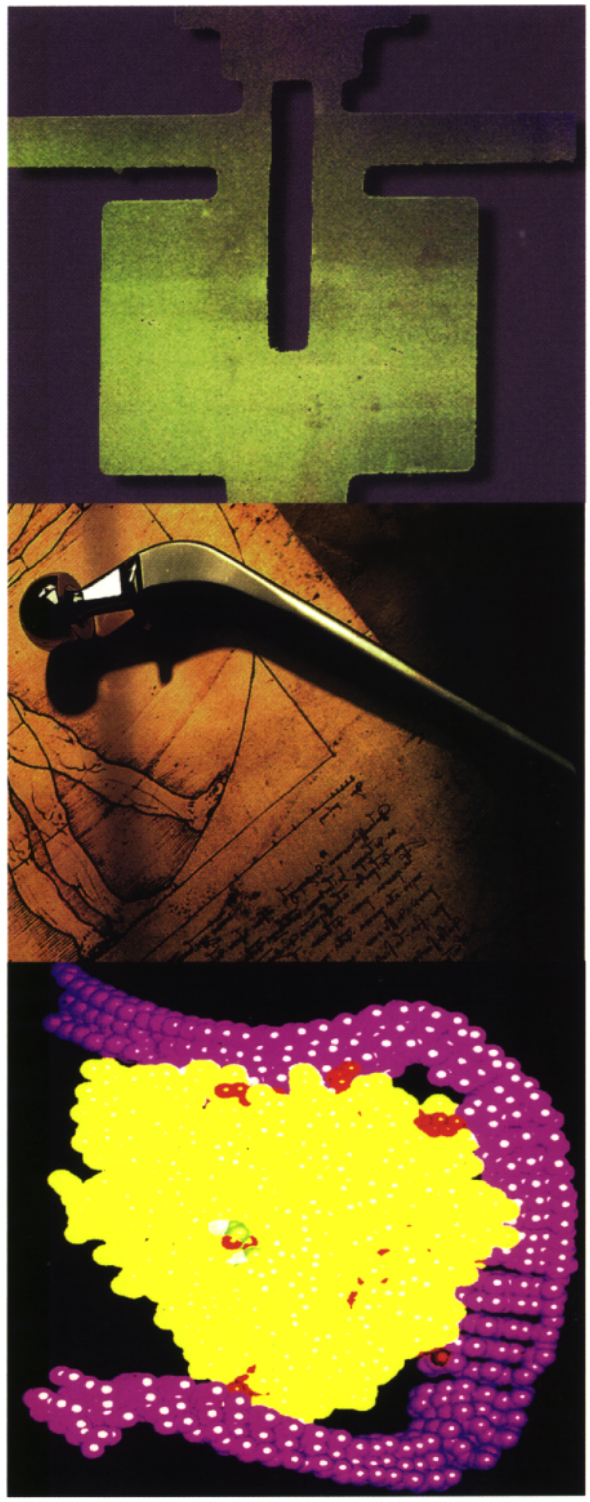
Basic Energy Sciences research touches people's lives in countless ways-from advances in energy and environmental technologies, to new materials and processes, to important spin-offs in industry and medicine. The few examples provided here illustrate the breadth and impact of BES discoveries.

Magnetic Materials. BES researchers have shown that making improvements in the processing of the core magnets used in transformers reduces energy losses by up to a factor of 10. Their results suggest that postprocessing improvements (e.g., surface annealing and laser scribing) could enhance the magnetic properties of transformer materials, significantly reducing the estimated $1B lost each year as a result of inefficiency in these materials.

Superconductors. BES researchers have developed the first practical application of the new high-temperature superconductors. The device, called a superconducting quantum interference device or SQUID, is a magnetometer capable of measuring minute magnetic fields, such as those emanating from the human heart and brain. The SQUID can also be used for nondestructive evaluation of materials for hidden flaws.

Catalysts. Enzymes valued at billions of dollars per year are used as catalysts, in industrial processes, in pharmaceuticals, and as specialty chemicals. BES researchers have developed a novel carbohydrate-based polymer that stabilizes a wide variety of proteins, including enzymes and antibodies, by wrapping around the protein surface to provide a unique and stabilizing microenvironment. The coatings allow enzymes to remain active in hostile industrial environments and prolong their useful lifetimes.

Wear-Resistant Surfaces. BES research on corrosion and wear has led to the development of an ion implantation technique that is used each year in processing more than 100,000 artificial hips, knees, and other orthopedic devices. This surface treatment produces remarkable improvement in the wear resistance of such devices, extending their useful lifetimes and increasing reliability.



Clockwise from upper left: superconducting SQUID, zeolite molecular structure, whisker-toughened ceramic, chemical vapor deposition model, synchrotron x-ray angiography, stabilized enzyme catalysts, ion-implanted hip joint.